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Direct Seeding

Proceedings

Direct Seeding in Wet Years

January 15, 1998
Dunvegan Motor Inn, Fairview, Alberta

AESA

PFRA
Prairie Farm Rehabilitation Administration

Alberta Reduced Tillage Initiative

Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT

Acknowledgements

Thanks to all the participants, speakers, helpers and the Dunvegan Motor Inn for their involvement in the Direct Seeding Workshop held on January 15, 1998 in Fairview. Approximately 120 people attended from across the Peace Region. Special thanks to the organizing group, including Randy Perkins of Alberta Agriculture, and Randy Graw and Blair English of PFRA for their assistance in locating sponsors, speakers, and advertizers.

Thanks to the sponsors, including Alberta Reduced Tillage Initiative, Peace Region Alberta Agriculture Fieldmen, Alberta Environmentally Sustainable Agriculture, Monsanto, Farm Credit Corporation, Ducks Unlimited, and Fairview College. Thanks to Monsanto and Zeneca for the major door prizes.

Thanks to those who set up displays in the "coffee room".

Special thanks to Linda Brazel for formatting and producing these proceedings.

John Zylstra
Conservation Coordinator, Peace Region
Conservation and Development Branch
Alberta Agriculture, Food and Rural Development

DIRECT SEEDING WORKSHOP
“Seeding in the Wet Years”

AGENDA

January 15, 1998

9:00 am	Introductions
9:15 am	**Climate in the Peace - Will Every Year be Wet?** - Peter Mills, Northern Alberta Research Center, Beaverlodge
9:45 am	**Pre-Seeding Spray Dates** - Garry Ropchan, Central Peace Conservation Society
10:00 am	**Pre-seeding Spraying vs Sweeps on Air Drill** - Garry Ropchan, CPCS
10:15 am	Coffee
10:35 am	**Producer Panel: Coping with Wet Conditions** - Richard Molenaar, Grande Prairie; Albert Michaud, Hawk Hills; Gary Lilge, Valleyview
11:45 am	John Keng, Soil Conservation Specialist, Alberta Agriculture
12:00 pm	Lunch
1:00 pm	**Fall Seeded Canola** - Jay Byer, Crop Specialist, Alberta Agriculture
1:40 pm	**Direct Seeding into Alfalfa** - Calvin Yoder, Forage Specialist, Alberta Agriculture
2:10 pm	**Corn Starch Effect on Yield of Zero-Till Wheat** - Garry Ropchan, CPCS
2:30 pm	Coffee
2:50 pm	**Gene-enhanced Crops, Impact on Direct Seeding** - Richard Guitard, Crop Specialist, Alberta Agriculture
3:20 pm	**Impact of Direct Seeding on Pea Diseases** - Paul Laflamme, Pulse Crop Specialist, Alberta Agriculture
4:00 pm	Displays, Door prizes, Comments, Home time!

Table of Contents

Climate in the Peace - Will Every Year be Wet?
Peter Mills, Northern Alberta Research Center . . . . Page 1

Pre-seeding Spray Dates
Garry Ropchan, Central Peace Conservation Society . . . . Page 11

Pre-seeding Spraying vs Sweeps on Air Drill
Garry Ropchan, Central Peace Conservation Society . . . . Page 14

Fall/early Spring Seeding
Jay Byer, Alberta Agriculture, Food and Rural Development . . . . Page 16

Direct Seeding Annual Crops into Alfalfa Stands
Calvin Yoder, Alberta Agriculture, Food and Rural Development . . . . Page 27

Corn Starch Effect on Yield of Zero-till Wheat
Garry Ropchan, Central Peace Conservation Society . . . . Page 33

Novel Trait Canola's and Direct Seeding: Do They Fit?
Richard Guitard, Alberta Agriculture, Food and Rural Development . . . . Page 35

Pea Disease Management in Conservation Tillage
Paul Laflamme, Alberta Agriculture, Food and Rural Development . . . . Page 38

Climate in the Peace - Will Every Year be Wet?

Peter Mills
Agriculture and Agri-Food Canada

14-Jan-98

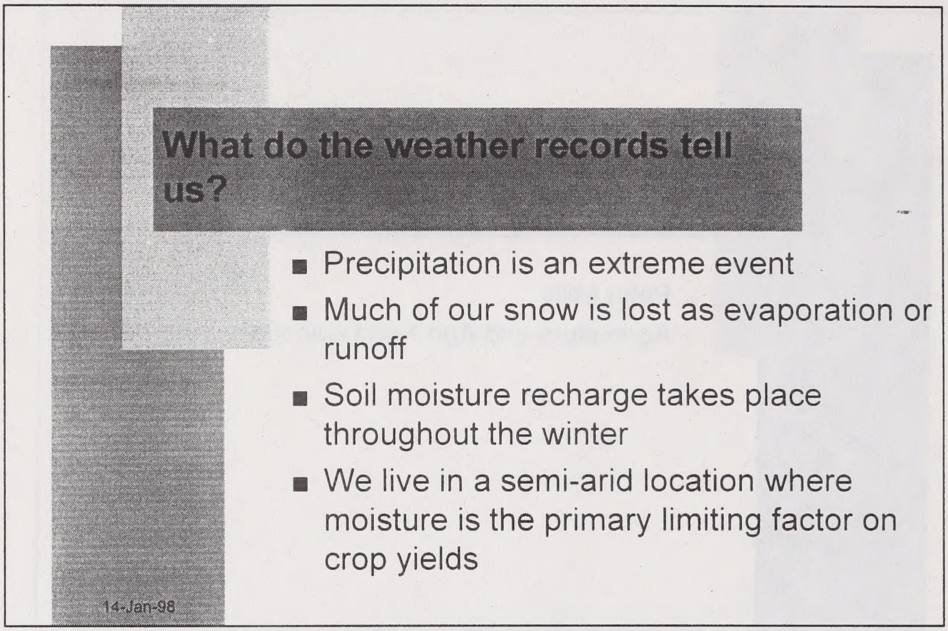
Weather vs. Climate

Weather:

- The conditions which exist within the atmosphere at any given time

Climate:

- The behavior of the atmosphere over time and the manner in which it interacts with the earth's "active layer"



What do the weather records tell us?

- Precipitation is an extreme event
- Much of our snow is lost as evaporation or runoff
- Soil moisture recharge takes place throughout the winter
- We live in a semi-arid location where moisture is the primary limiting factor on crop yields

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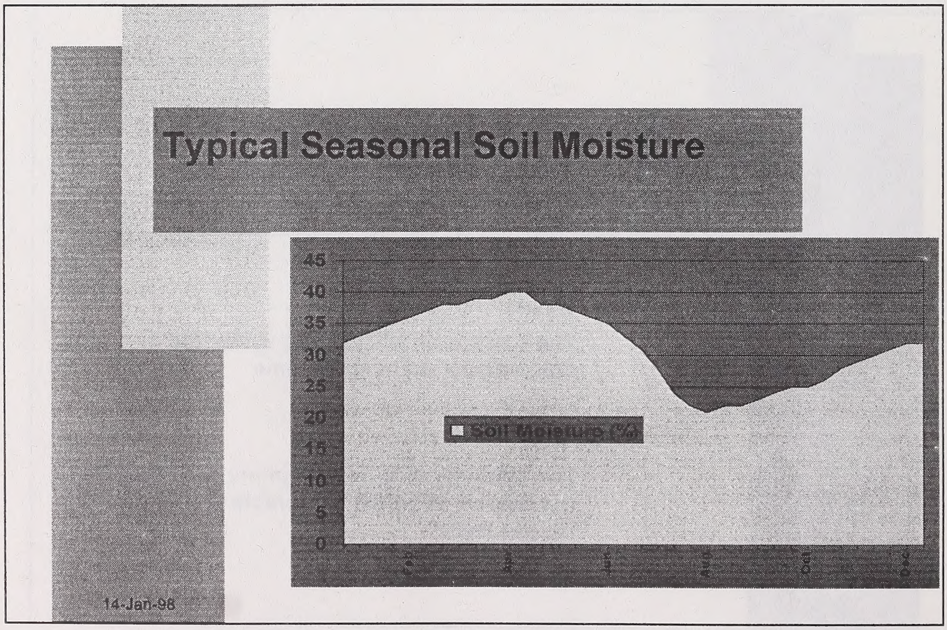

Typical Seasonal Soil Moisture

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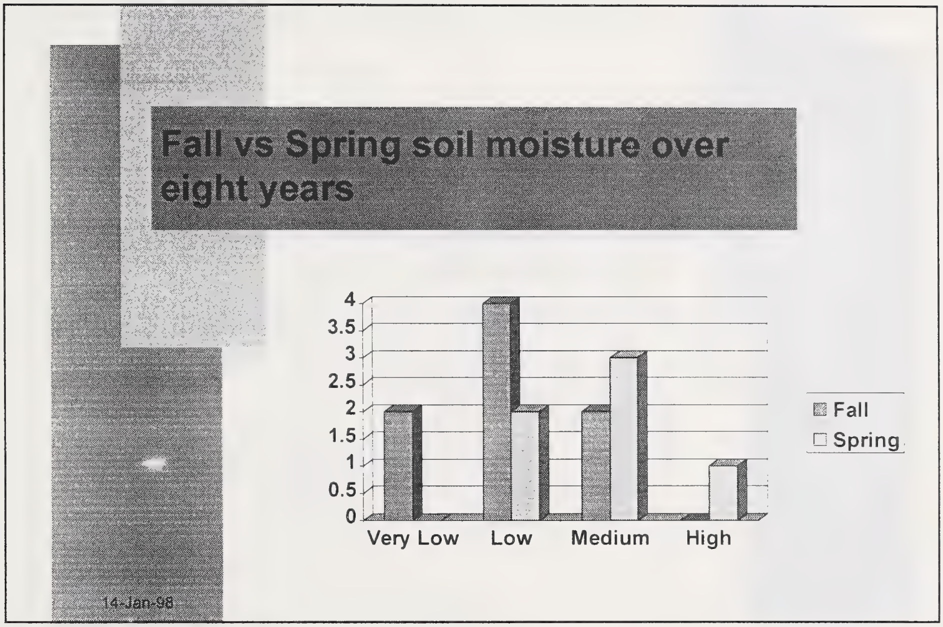

Fall vs Spring soil moisture over eight years

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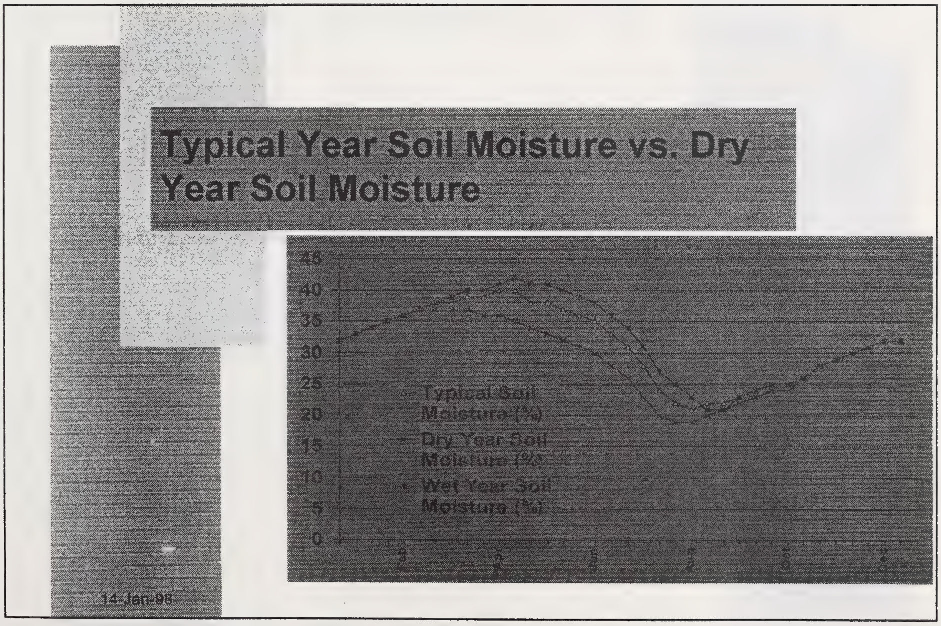

Typical Year Soil Moisture vs. Dry Year Soil Moisture

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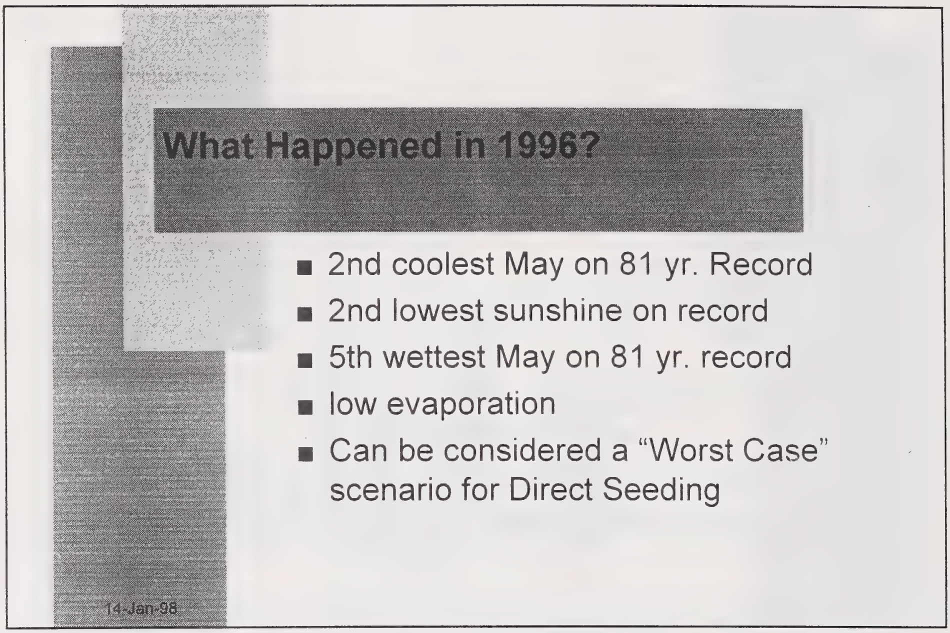

What Happened in 1996?

- 2nd coolest May on 81 yr. Record
- 2nd lowest sunshine on record
- 5th wettest May on 81 yr. record
- low evaporation
- Can be considered a “Worst Case” scenario for Direct Seeding

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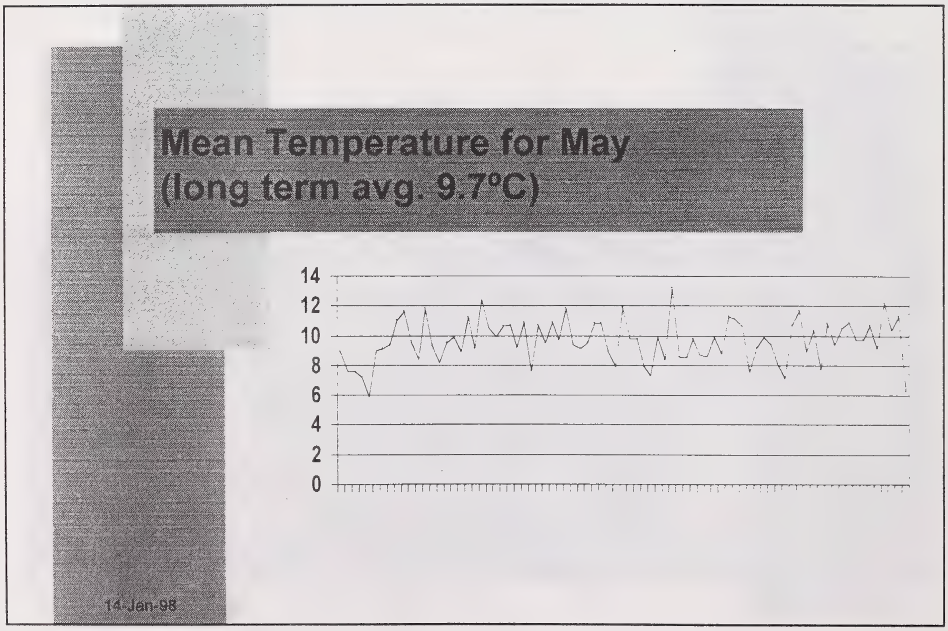

Mean Temperature for May (long term avg. 9.7°C)

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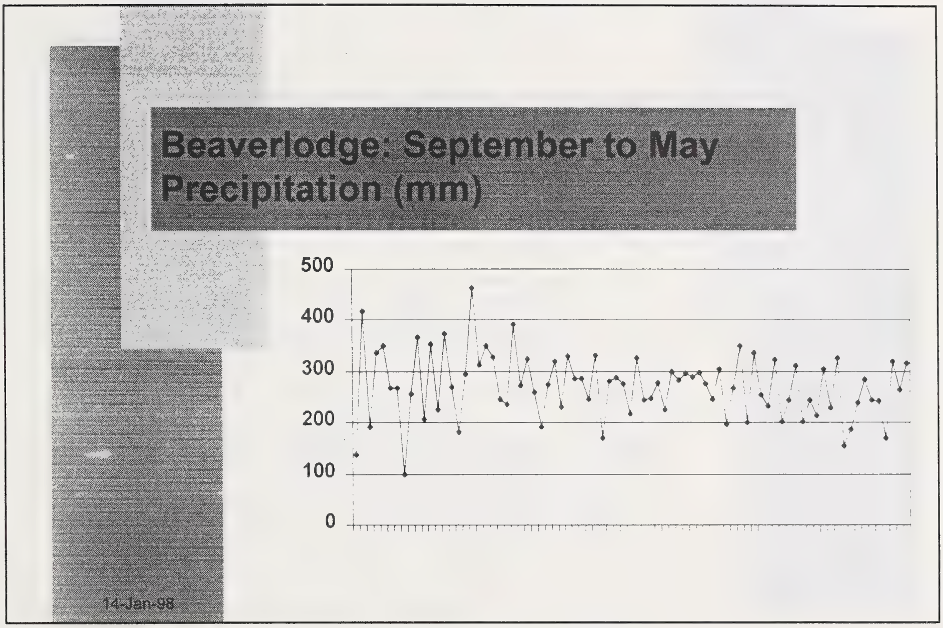

Beaverlodge: September to May Precipitation (mm)

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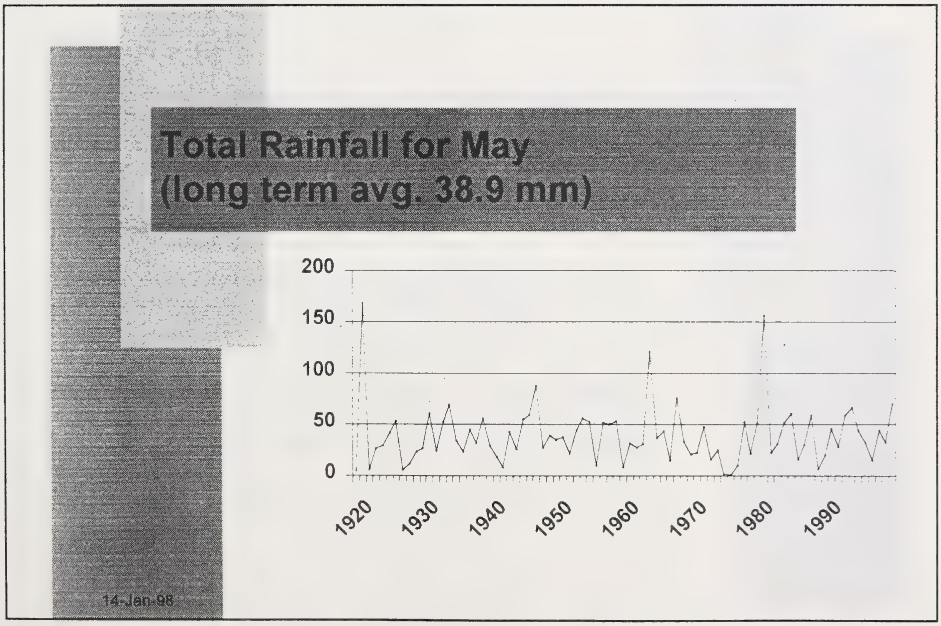

Total Rainfall for May (long term avg. 38.9 mm)

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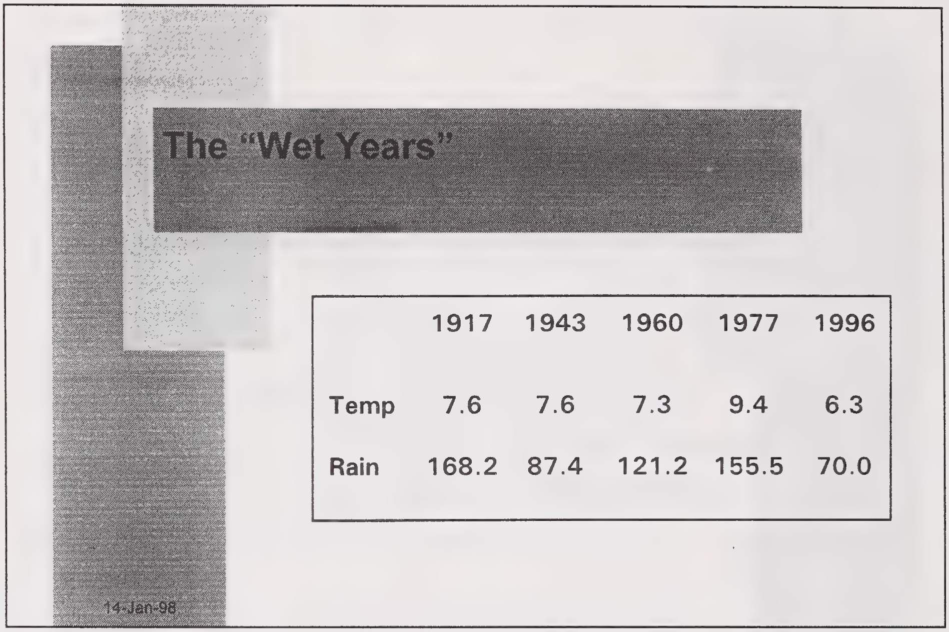

The "Wet Years"

	1917	1943	1960	1977	1996
Temp	7.6	7.6	7.3	9.4	6.3
Rain	168.2	87.4	121.2	155.5	70.0

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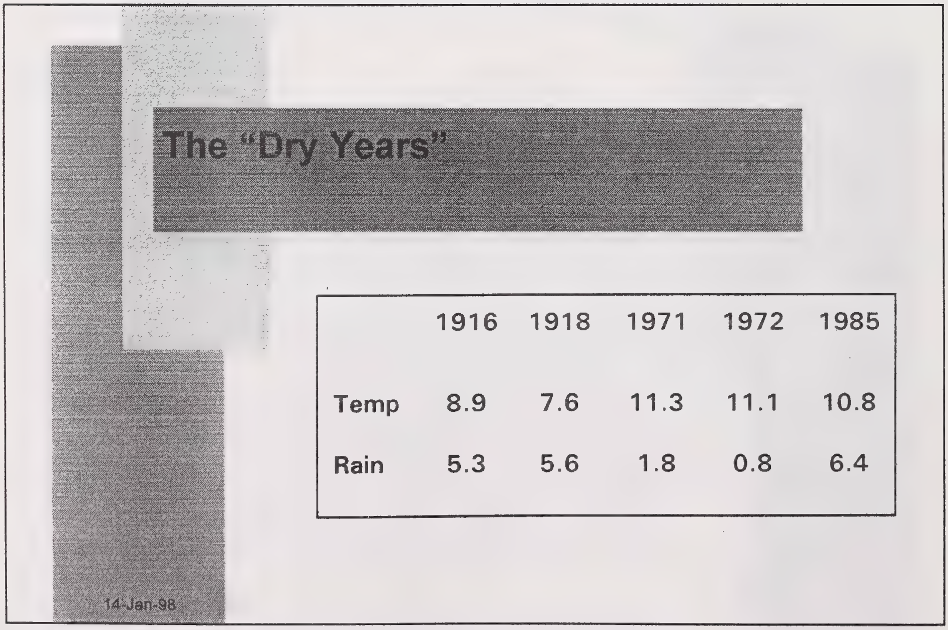

The "Dry Years"

	1916	1918	1971	1972	1985
Temp	8.9	7.6	11.3	11.1	10.8
Rain	5.3	5.6	1.8	0.8	6.4

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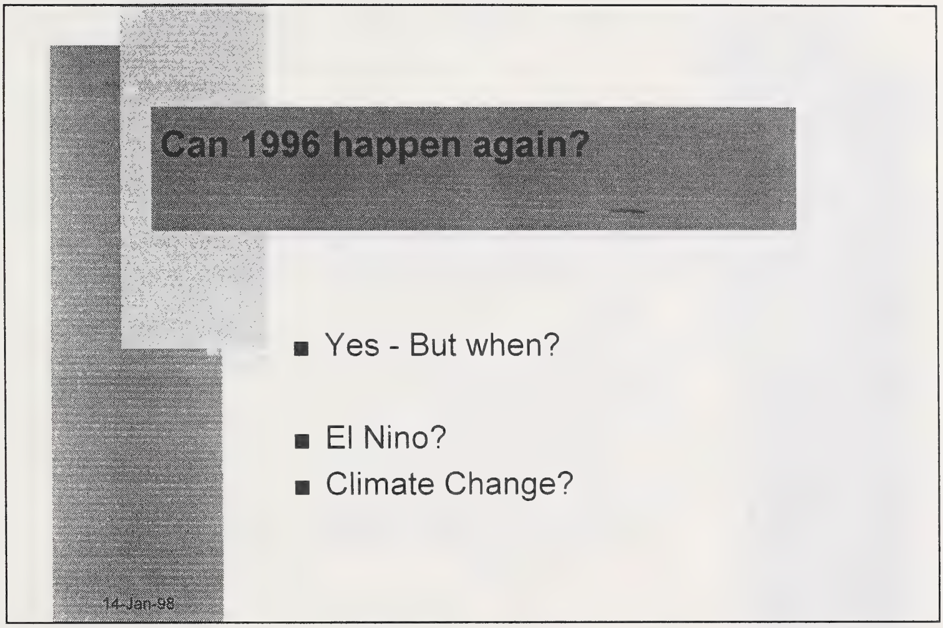

Can 1996 happen again?

- Yes - But when?
- El Nino?
- Climate Change?

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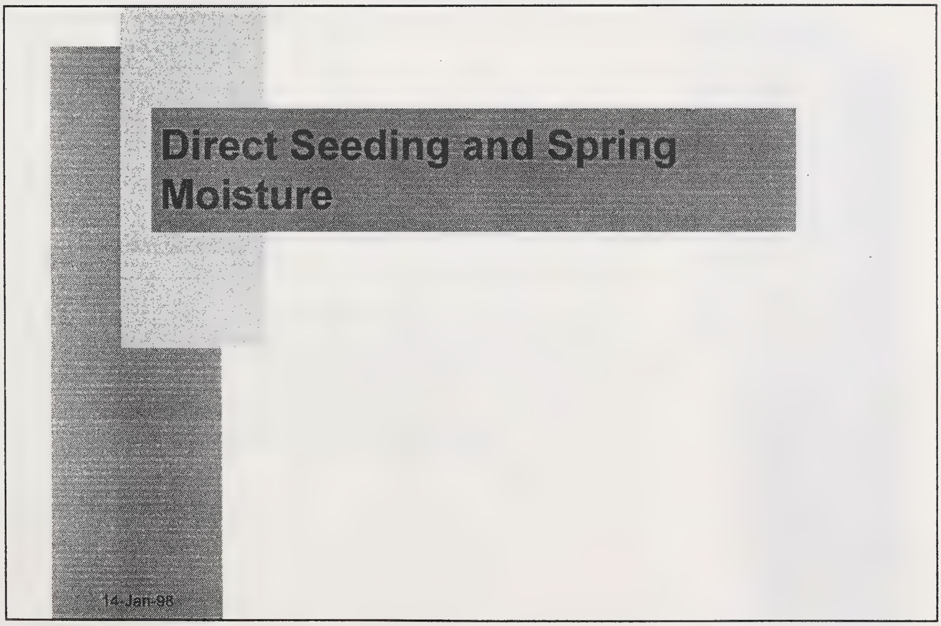

Direct Seeding and Spring Moisture

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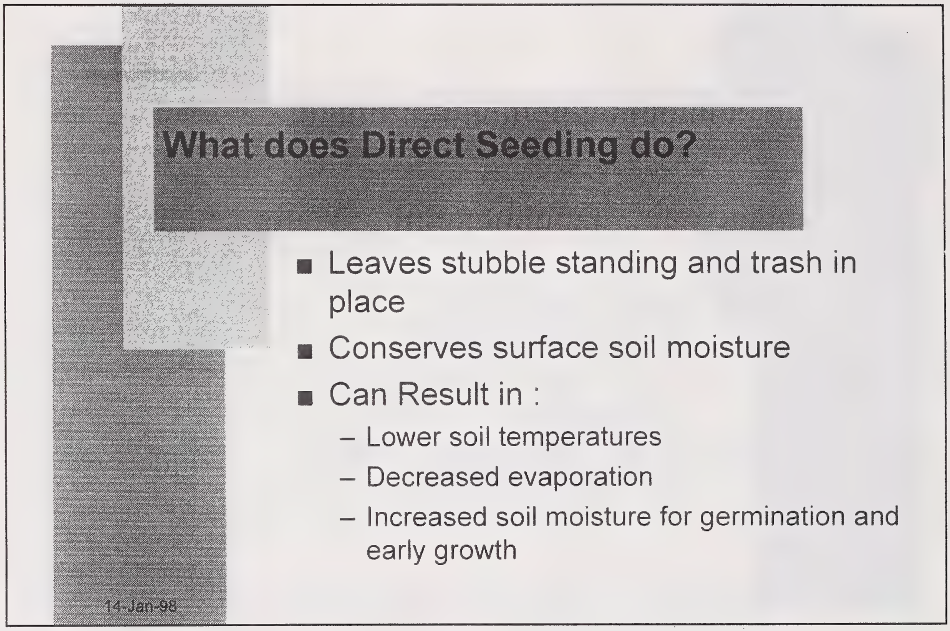

What does Direct Seeding do?

- Leaves stubble standing and trash in place
- Conserves surface soil moisture
- Can Result in :
  - Lower soil temperatures
  - Decreased evaporation
  - Increased soil moisture for germination and early growth

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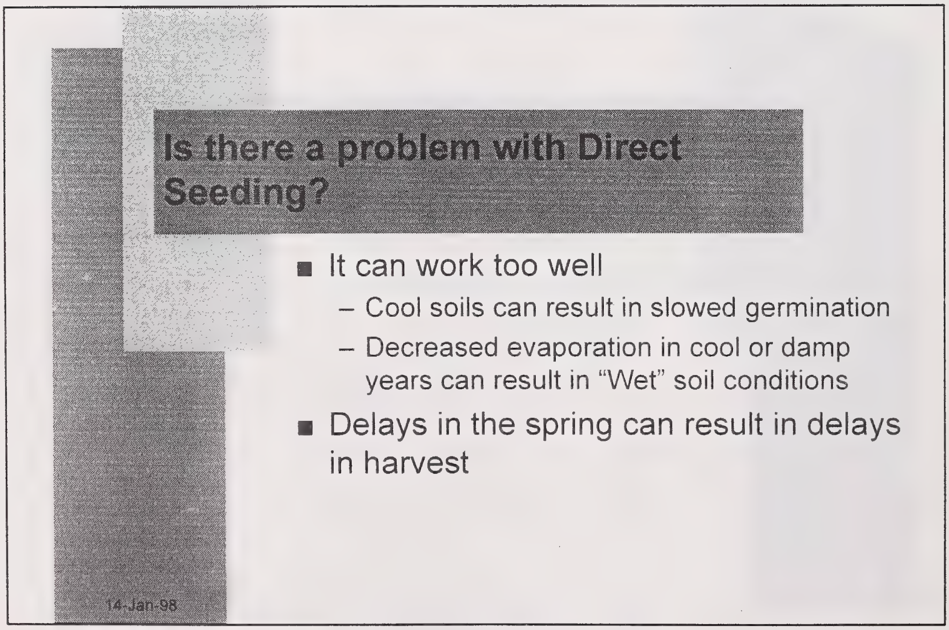

Is there a problem with Direct Seeding?

- It can work too well
  - Cool soils can result in slowed germination
  - Decreased evaporation in cool or damp years can result in “Wet” soil conditions
- Delays in the spring can result in delays in harvest

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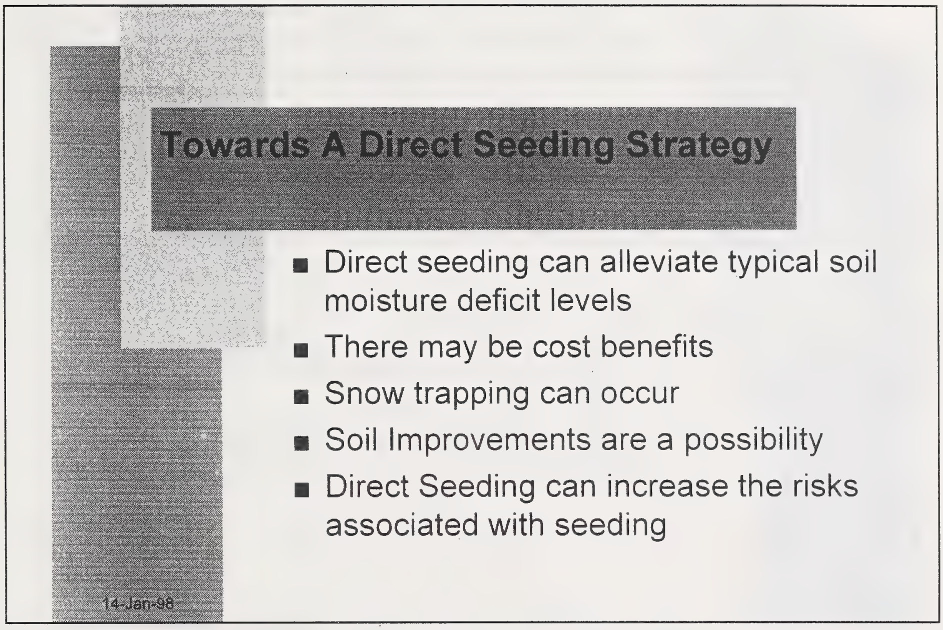

Towards A Direct Seeding Strategy

- Direct seeding can alleviate typical soil moisture deficit levels
- There may be cost benefits
- Snow trapping can occur
- Soil Improvements are a possibility
- Direct Seeding can increase the risks associated with seeding

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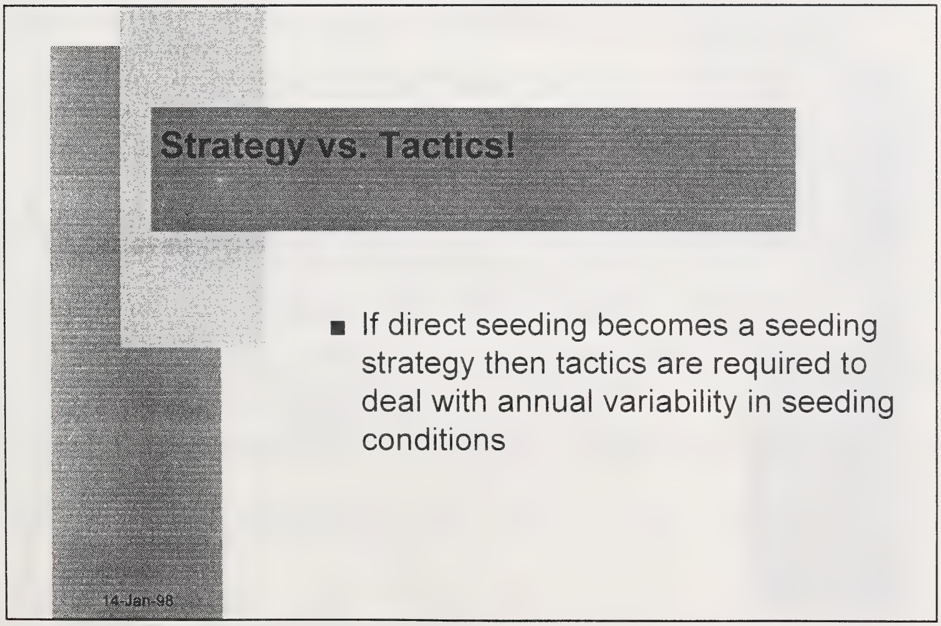

Strategy vs. Tactics!

- If direct seeding becomes a seeding strategy then tactics are required to deal with annual variability in seeding conditions

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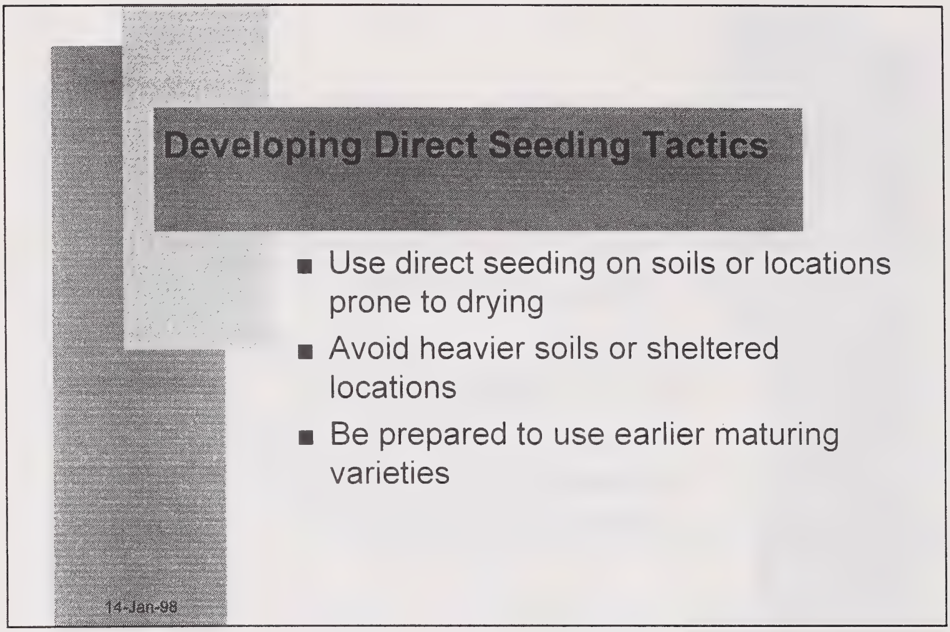

Developing Direct Seeding Tactics

- Use direct seeding on soils or locations prone to drying
- Avoid heavier soils or sheltered locations
- Be prepared to use earlier maturing varieties

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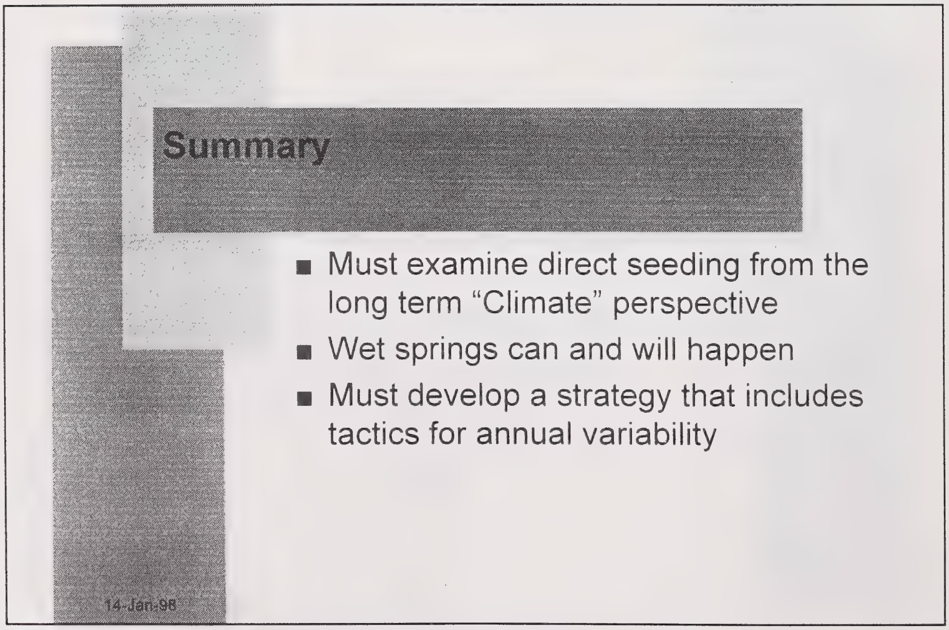


Summary

- Must examine direct seeding from the long term “Climate” perspective
- Wet springs can and will happen
- Must develop a strategy that includes tactics for annual variability

14-Jan-98

Pre-seeding Spray Dates

Garry Ropchan, Research Coordinator
Central Peace Conservation Society (CPCS), Spirit River

ACKNOWLEDGMENTS

The success of the Central Peace Conservation Society requires the combined efforts of many individuals and groups. I wish to recognize the following groups and individuals.

Alberta Environmentally Sustainable Agriculture (A.E.S.A.)

M.D. #19 Council, Ag. Service Board and staff
M.D. #20 Council, Ag. Service Board and staff
M.D. #133 Council, Ag. Service Board and staff
Prairie Care/Ducks Unlimited-Rene Labbe
Monsanto Canada-Stewart Doram
UGG-Spirit River-Duane Payeur

EFFECT OF TIME DELAY BETWEEN BURNOFF APPLICATION AND SEEDING

- the origins of this project go back to the emergence problems we were encountering when seeding annual crops into fescue - that the decomposing sod might be increasing disease problems
- I asked around, no one knew anything solid about this potential problem
- further digging came across a report in which some Montana researchers found that there is a link between when the burnoff herbicide is applied and when the crop is seeded and root disease levels - Rhizoctonia and Pythium root rot on wheat and barley and take-all of wheat
- simply put, healthy plants have some ability to protect themselves from diseases
- plants that are dying after being sprayed with the burnoff herbicide have less ability to protect themselves
- disease pathogens attack these dying plants and can use them as a food source to rapidly increase in population
- the peak in pathogen population occurs about 72 hours after burnoff application, this is traditionally when ZT'ers seed the crop
- the higher pathogen population is then in an excellent position to attack the newly planted seeds
- the question is, does this phenomenon occur in Northern Alberta?
- CPCS conducted tests in 1996 and 1997

1996 Trial

- the trial was conducted with Scott Barlund east of Wanham
- since the burnoff is normally applied before seeding we studied the effect of three different

burnoff days before seeding (DBS), we used 19, 8 and 4 DBS (May 23, June 3 and June 7)
- main problem weeds were dandelion, narrow-leaved hawk's-beard and stinkweed
- all three burnoff herbicide applications consisted of 0.5 l/ac Roundup, 0.5 l/ac ammonium sulfate in 5 gal/ac water
- we seeded 95 lb/ac of Brier barley on June 11 at a depth of 1 inch using a Haybuster 8000 hoe drill, the fertility program was 60-27-11-6
- weed control achieved by the burnoff herbicide application appeared to be very effective, as we returned for each subsequent spraying date the previously applied herbicide application could be observed and was very impressive, especially against dandelion
- hawk's-beard and stinkweed were likewise fully controlled
- root samples were obtained at two different leaf stages but plating them out did not find differences in disease levels between the different spraying dates
- incrop weed control was with the recommended rate of Prevail, very little weed pressure existed after this
- there were no visible differences that could be observed between the different spraying dates as the crop was growing which leads to the question:

IS THERE A DIFFERENCE?

Results of different burnoff dates on zero till barley production, Barlund site, 1996

Treatment	Yield bu/ac*	% Moisture*	% Dockage*	Bu Weight**	Contribution Margin
9 DBS	70.1a	17.0a	0.7a	43.0a	$166.82
8 DBS	73.5 b	17.1a	0.5a	41.7 b	$175.32
4 DBS	70.9a	16.9a	0.5a	42.2 b	$168.82

*means within each column followed by different letters were significantly different at P=0.05

**means within each column followed by different letters were significantly different at P=0.01

Results

1) 8 DBS produced a significantly higher yield than the 19 and 4 DBS
2) 19 DBS produced a significantly higher bushel weight than the 8 and 4 DBS

WHY WAS THERE A YIELD RESPONSE?

- disease testing of roots found no differences in disease levels
- dockage testing found no differences in the dockage level
- the answer is unknown at this time, further studies would have to be conducted in 1997

1997 Trial

- the trial was conducted with Otto Toerper, west of Northmark
- Otto was interested in the performance of spraying after seeding compared to before seeding
- his reasoning was that more weeds might germinate and thus he would get better performance compared to spraying before seeding

- so we looked at the effect of three different burnoff days, two dates before seeding (DBS) and one date after seeding (DAS)
- we used 19 and 7 DBS and 5 DAS (May 11, May 23 and June 4)
- all burnoff herbicide applications 1.0 l/ac Roundup, 1.0 l/ac ammonium sulfate in 5 gal/ac water
- the main weed problems were quack grass, dandelion, alfalfa, vetch
- we seeded Roblin wheat on May 30 at a rate of 100 lb/ac at a depth of 1 inch with a Haybuster 7000 hoe drill, fertility program was 35-33-0-0 deep banded

Observations

- 19 DBS weeds were well on their way to dying as the 7 DBS was sprayed
- both 19 and 7 DBS were found to have had good control as 5 DAS was applied
- 5 DAS weeds were not as well controlled as either DBS treatment, especially in the case of dandelion
- none of the treatments were effective in controlling alfalfa
- incrop weed control consisted of MCPA K salt at 500 ml/ac
- Again, is there a difference?

Results of different burnoff dates on zero till wheat production, Toerper site, 1997

Treatment	Yield bu/ac*	% Moisture*	% Dockage*	Contribution Margin $/ac
19 DBS	32.0a	24.2a	1.2a	$92.15
7 DBS	32.8a	23.5b	1.7a	$94.79
5 DAS	25.9b	25.5c	1.7a	$72.02

*means followed by the same letter within a column do not differ at P=0.05
feed wheat @ $3.30, spraying costs $8.95+$1.00+$3.50=$13.45

Conclusions

1) Weed control is better performed prior to seeding. I have had personal experience with this myself and found this to be very true .
2) Good control can be had by spraying as early as 2 1/2 weeks prior to seeding, even though the growth may not look like it justifies it, eg. cleavers.
3) About 1 week prior to seeding seems to be ideal.

Pre-seeding Spraying vs Sweeps on Air Drill

Garry Ropchan, Research Coordinator
Central Peace Conservation Society (CPCS), Spirit River

DO I NEED A BURNOFF HERBICIDE IF MY AIRDRILL HAS CULTIVATOR SWEEPS?

- there is a good body of work that supports that income levels will not drop if producers convert to zero till
- I have little doubt that the majority of zero tilling will be performed by airdrills
- as farms get larger in size the convenience of the airdrill, large volume capacity, ease of cleanout and loading, wide operating width and ease of transport will be a popular choice
- there appears to be two schools of thought regarding airdrills:
  1) airdrills that have narrow openers, this includes specific drills like the Harmon as well openers are available for others, like the Concord, Flexi-Coil, Morris
  2) purpose built airdrills using wide, cultivator sweeps, this includes specific drills like the Victory or New Noble Seed-o-Vator, as well openers are available for others again like the Concord and Borgault
- this begs the question, why would you want to use a narrow opener or a sweep?
- there are as many reasons as there are producers in attendance
- you may want a high degree of seedbed utilization (sweeps), lower draft (probably narrow opener), reducing weed seed germination (narrow opener)

Effect of Tillage on Wild Oat Populations

System	# wild oats/m2
1 fall, 2 spring passes	505
2 spring tillage passes	359
1 spring tillage pass	371
Zero Till (no burnoff)	131

source K. Kirkland, Agriculture Canada, Scott, Saskatchewan

- there is a school of thought by sweep users that they can skip the burnoff herbicide application
- these producers have good crops, but could they be better?
- I needed a producer who was zero tilling using an airseeder equipped with sweeps when a burnoff herbicide is used and without the burnoff herbicide
- John Sekulic of Rycoft was one such producer and agreed to be the cooperator for this trial
- John zero tills with a 40' Concord airdrill that has 12" sweeps on 10" row spacing, this means that while the sweeps are still fairly new he has 100% disturbance of the seed bed (2" overlap)

- I applied a burnoff herbicide consisting of 1.0 l/ac Roundup, 0.5 l/ac A.S. in 5 gal/ac water on May 15th
- the major weeds at this time were dandelion, stinkweed, field horsetail and narrow-leaved hawk's-beard
- while the normal burnoff rate would be 0.5 l/ac Roundup, the lateness of the spring and the growth stage of the dandelions warranted 1.0 l/ac rate
- the field was seeded to Quest canola (5 lb/ac) on May 17th
- the fertility program consisted of 80-0-0-0 deep banded and 17-23-2-15 seed placed
- an incrop herbicide of 0.5 l/ac Roundup in 8 gal/ac water was applied on June 9
- the plot was swathed on Sept 3 and combined on Sept 25
- the weed control appeared to be fairly good across the entire plot, no differences could be seen between treatments

Results of Using a Burnoff When Seeding With an Airdrill Using Sweeps

Treatment	**Yield bu/ac***	**% Dockage***	**Gross $/ac**	**Herbicide $/ac**	**Net Return $/ac**
Unsprayed	23.0a	10.0a	161.00	0.00	161.00
Sprayed	30.1 b	9.0a	210.70	13.20	197.50

*means followed by the same letter within a column are not significantly different at $P=0.05$
canola @ $7.00/bu, Roundup @ $8.95/l, A.S. @ $1.00/l, spraying @ $3.25/ac

- while 23.0 bu/ac canola is nothing to be disappointed with, especially in a year like 1997, by adding a burnoff herbicide his yield increased to 30.1 bu/ac and an additional $36.50 of income after covering the burnoff herbicide costs was realized!

Conclusions

- top levels of weed control may not be possible with a single tillage pass (it wasn't in our old tillage seeding system, why should we expect it to be in zero till seeding system?)
- even though things may look acceptable, they can always be made better (like $36.50 per acre better!)
- further work will be conducted in 1998 if we can find cooperators in MD 19, 20 or 133

Additional Comments

- weed control is the most critical issue to being successful in zero tilling
- if you try to skip the burnoff, seed to soon after the burnoff or try the burnoff after seeding you will run into problems
- the burnoff has been one of the best investments I make every spring - I want my crop to be emerging in a weed free situation so it will be as competitive as possible when post seeding weeds germinate

Fall/early Spring Seeding

Jay Byer, Crop Specialist
Alberta Agriculture, Food and
Rural Development, Bonnyville

Advantages, Disadvantages.
Results and Recommendations

Advantages

- Early maturity
- Reduced losses
- Early season moisture utilization
- Early weed competition
- Harvest season spread out

Early Maturity

- reduced risk of frost causing crop damage and/or downgrading
- can seed argentine rather than polish canola in short season zones
- later maturing varieties can be seeded
- oil content may be higher
- marketing opportunities may be improved

Reduced Losses

- Reduction in damage by infestations of insects such a diamond back, bertha, or lygus, which normally attack mid to late August
- Diseases such as alternaria, sclerotinia, and blackleg may have a reduced impact, less effect of crop quality and quantity

Early Season Moisture Use

- generally good seed bed conditions
- is a good fit with direct seeding systems
- early moisture utilization
- cooler temperatures generally at flowering and seed set

Early Weed Competition

- Early emerging crops can often get a jump on later emerging weeds
- herbicide tolerant varieties allow for more early emerging weed control options

Harvest Season Spread Out

- Production efficiencies can result from spreading out the harvest period and making better utilization of harvest equipment

Disadvantages

- Untimely germination
- Risk of new pest infestations
- Site selection limitations
- Cost of weed control
- Operations may coincide

Untimely Germination Risks

- Fall or winter germination could reduce spring plant populations
- Early spring frosts may damage crops, but so far this has not been shown to be a problem

Risks of New Pest Infestations

- Are we increasing the potential for cabbage seed pod weevil to become a pest of early maturing canola pests?
- Will flea beetles be more serious problem when early emerging canola is virtually the only green material in the spring?

Site Selection Limitations

- Areas prone to standing water in the spring should not be selected
- Exposed areas should not be used, or have standing stubble for protection

Costs of Weed Control

- Herbicide tolerant canola may have extra costs associated with them
- Does the net cost actually increase when the full package of seed purchase and weed control is actually considered?

Operations May Coincide

- Fall or early spring seeded canola may need to be sprayed during seeding operations, harvesting during haying, etc..

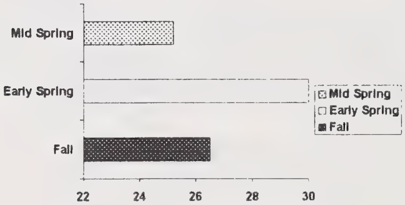
Results

- Research
  - Long term, Scott
  - Short term Fort Kent
- Demonstration
- Survey

Growth Stage Range at Scott

Stage	Fall	Early Spring	Mid Spring
Seeded	Oct 27-31	Apr 25-May 5	May 9-23
Emerged	Apr 23-M 1	May 9 -12	May 18-29
50% Flower	June 11- June 15	June 21-27	June 23- July 9
Swathed	July 25- Aug 3	July 29-Aug 11	Aug 9-19
Combine	Aug 3-15	Aug 8-16	Aug 23-27

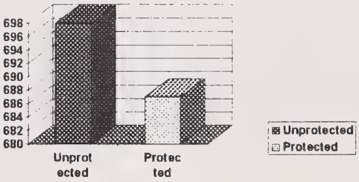
Scott Average Yield, 1994-96



1996-97 Fort Kent Trial

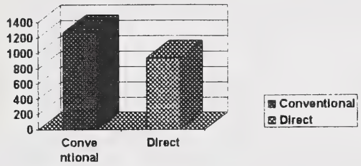
- Compared
  - Coated to uncoated seeded
  - Direct to conventional
  - Fall to early spring to mid spring

Coated to Uncoated Canola



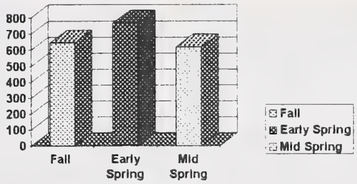
NO Significant Difference

Conventional vs direct



Significant Difference 91.7 Kg/ha

Fort Kent Yield, one year



NO significant differences

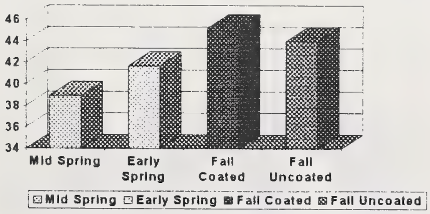
Observations at Fort Kent

- ❖ Yield differences not significant, followed trend set at Scott
- ❖ Maturity differences also similar
- ❖ Conservation tillage a question, looking at root maggot damage, etc.
- ❖ NO results on whether fall protection worked

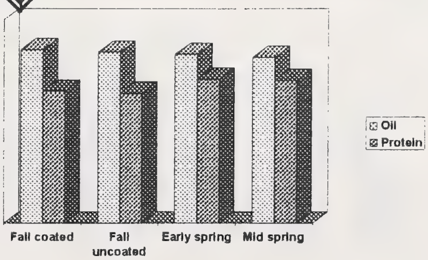
Results from Demonstration

- ❖ Several hundred people viewed the results at the Alberta Reduced Tillage Initiative Site At Willingdon
- ❖ Good cooperator, may have made fall and early spring seeding look too easy
- ❖ Showed that fall and early spring seeding can work with reduced tillage

Yield From Willingdon Demo

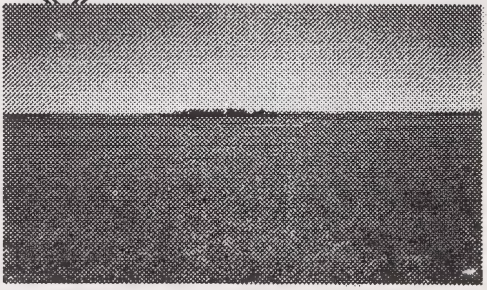


Oil/Protein data, Willingdon



Fall seeding, Willingdon 29/7/97

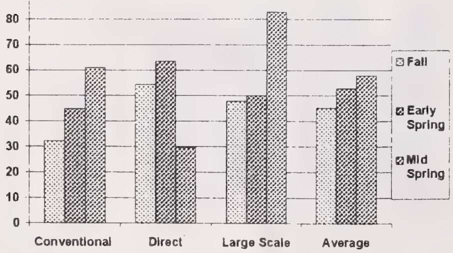
Early Spring Willingdon 29/7/97



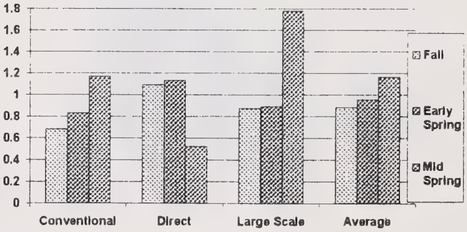
Mid Spring Willingdon, 29/7/97

Early, mid spring Camrose 28/7

Root Maggot Incidence vs Dates



Severity of RM Damage vs Dates



Fall/Early Spring Seeding Survey Results to date:

- Trial Size
- Seeding Method
- Seeding Rate
- Maturity Advancement
- Yields
- Percent of Normal and Long Term Yields

Survey Results

	Fall	Early Spring
Trial Size-acres	118	55
Seeding Method		
Broadcast	12 - 2	2 - 0
Drilled	6 - 2	1 - 0

Problems: 2 seed depth, 1 herbicide, & 1 soil too wet at seeding

Survey Results

	Fall	Early Spring
Seed rate-Pounds	7.7	6.7
Earlier Maturity-days	17.0	4.6
Yield-bushels/acre	37.3	36.8
% of mid Spring Yield	111	118
% of 5-Year Average	112	109

Survey Interpretation

Are these results statisically significant?

--No, they are based on estimates

--No yield data was taken

--Survey numbers are small

What do they tell us?

Fall and early spring seeding can be successful but may not always be.

Current Recommendations

- Field Selection
- Variety Selection
- Timing
- Fertility
- Seeding Rate
- Seeding Method
- Seeding Depth

Field Selection

- Avoid low spots that drown out in the spring
- Windswept slopes could be a problem
- Select a small areas to try first until we have a greater understanding of fall or early spring seeding

Variety Selection

- A herbicide tolerant variety offers your best options for early spring weed control
- If weed control is not a problem, a high yielding variety is your next consideration

Timing

- If fall seeding wait until the soil is cold (3-5 degrees C) before seeding
- If spring seeding, plant as early as the soil can be worked. Frosts up to -8 Celsius do not appear to have as great an effect if the seed germinates in cold soils

Fertilizer

- Apply recommended fertilizer, either all in the fall, or part in the fall and top dress the rest in the spring
- Ensure and adequate N-S ratio
- Don't ignore micronutrients

Seeding Rate

- Use a regular to slightly higher seeding rate
- Plant populations requires are the same, regardless of fall, early spring or mid spring seeding

Seeding Method

- Seed in a way that allows good seed to soil contact for optimum spring emergence
- Consider direct seeding where appropriate and necessary to minimize untimely germination
- Avoid ridges in fall germination; soil slumping could increase net seed depth

Seed Depth

- Seed no more than 1/2 inch deep due to the additional time it takes seed to emerge in cold soils
- Use treated seed to minimize the effect of diseases during germination and emergence
- consider packing for good seed to soil contact, but do not over pack

Future Work

- Producer Surveys
- Hormone or barrier treated seed
- High yielding really long season work
- double cropping with polish varieties
- various seeding rates and varieties
- fertility placement and timing issues
- seeding methods and timing

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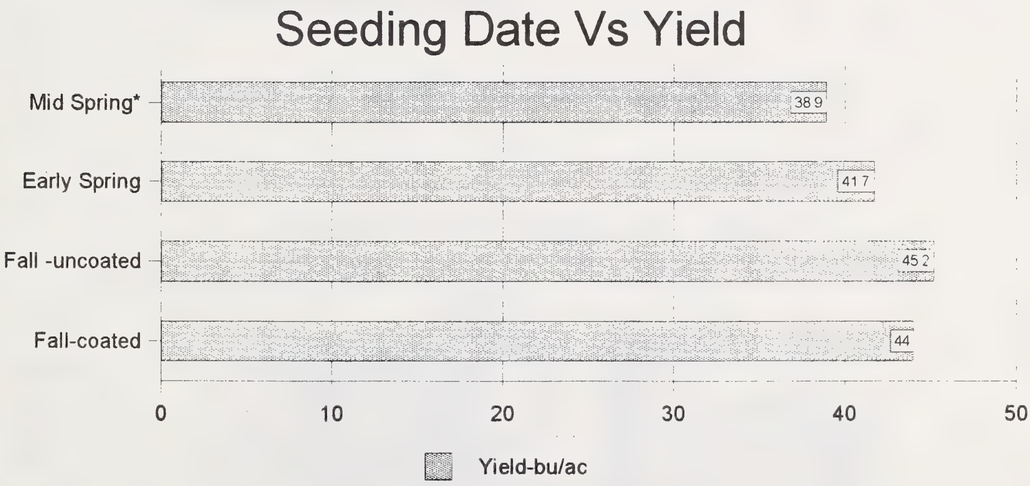
Fall/Early Spring Plot at the ARTI Site Near Willingdon



* Mid spring seeding was a different variety

What factors may have affected these yields up or down?

Field variation — this was an even, apparently consistent field

Herbicide drift — we may not have excluded as much of an area that was phenoxy affected on the early spring and mid spring as we did on the fall treatments

Insect/disease damage — did we have more impact on one seeding date or the other due to insects such as root maggots and diseases such as sclerotinia? This is being looked into.

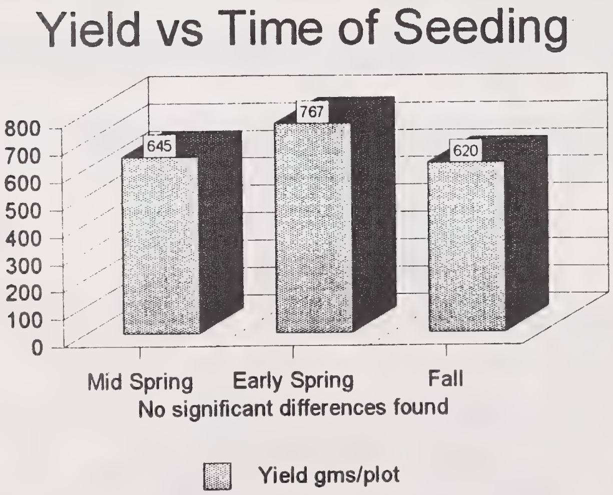
What can we draw from these figures?

1. Fall and early spring seeding can work well in east central Alberta.
2. There appeared to be maturity advancements on fall (3 weeks) and early spring (2 weeks) seeding date.
3. The fall seeded material did not appear to be as heavy as the early spring varieties
4. The fall material did have high oil content 45.9%. How does this compare to other seeding dates? We don't know yet.
5. A tonne/acre of canola can be achieved on fall and early spring canola with good management.
6. Fall and early spring herbicide tolerant canola can produce a nice, clean stand.
7. With weather delays for the spring seeded canolas, the fall material was harvested about a month earlier than the early and mid spring.

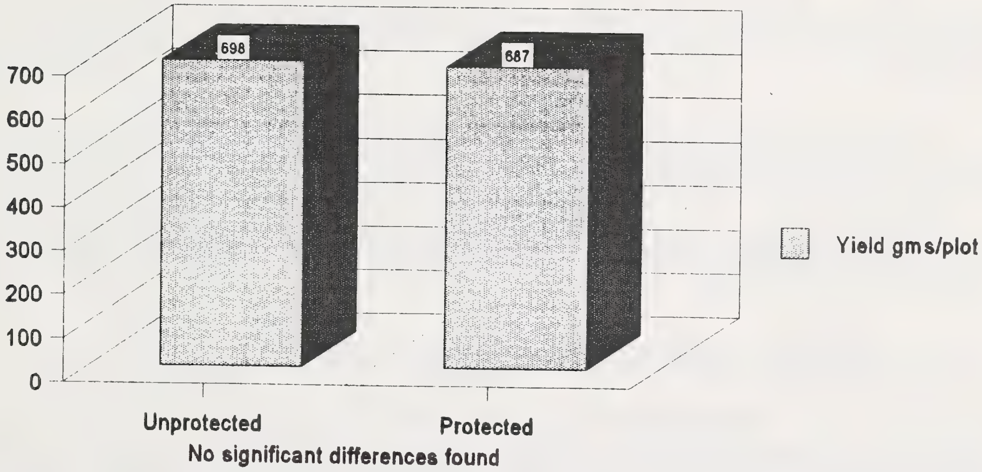
What we CAN'T conclude (yet) from these figures:

1. This was not a randomized trial, so we can't tell if any yield differences are significant.
2. The coated and uncoated fall material went in just as the first permanent snow was falling, so we can't tell if the coating worked or not.

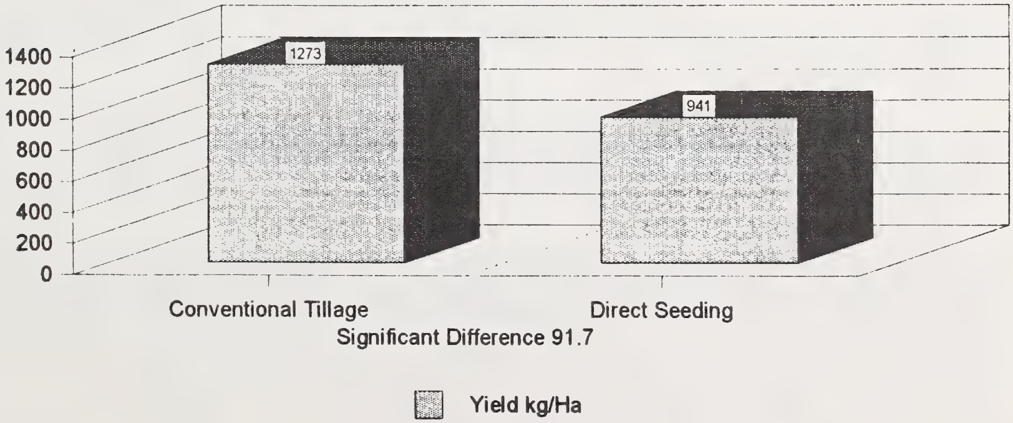
Fall/Early Spring Seeding of Canola Plot Observations



Coating vs Yield



Conventional Tillage Vs Direct Seeding



1. Bushel weights were not significantly different in any treatment.

2. Yields were generally disappointing translate into mid to high teens. No difference was statistically significantly better than any other. Yields from variety and other plots have not been analysed yet for comparison purposes. Lygus bug infestations may have been a factor.

3. Root maggots may have affected direct seeded treatments more than conventional. Samples have been sent away to determine if there were significant differences in root maggot damages.

4. Hair pinning was not noted this year in direct seeding in the fall, and plant counts did not seem to be different in conventional vs direct seeded fields.

5. The extra snow trapped by the stubble did not significantly improve yield or germination from the observations made.

6. Fall and early spring seeding was not significantly worse than mid spring seeding.

7. The results in Fort Kent were similar to the results obtained over several years in Scott, Saskatchewan, where while there may have been no significant difference the trends were that the early spring treatments had the highest numerical value, followed by fall, with the mid spring having the lowest numerical value.

8. Some flea beetle damage was noted, but no difference was noted among treatments.

9. Maturity differences were also similar to the results found in Scott, Saskatchewan, in that there was roughly a three week maturity advancement for the fall seeded treatments and a two week maturity advancement for the early spring treatments.

10. Surveys of fall seeders to date show that many successes have been achieved through broadcast seeding. Surveys of failures to date have been attributed to such aspects as deep net seeding depth.

11. The majority of fall seeders to date have been satisfied with their results from this innovative technique and are experimenting on their own to maximize their fall or early spring potential.

12. The plots got in just before the snow came and stayed. Therefore we do not know whether or not the coating prevented germination in the fall. Plots put in this year may show a difference.

Direct Seeding Annual Crops into Alfalfa Stands

Calvin Yoder, Forage Specialist
Alberta Agriculture, Food and Rural Development, Falher

Introduction

Direct seeding annual crops into alfalfa fields terminated with herbicides is being done successfully under both research and field scale conditions. Traditionally producers use tillage or a combination of herbicides and tillage to terminate an alfalfa stand in order to prepare a suitable seed bed for an annual crop. An alternative to tillage is to terminate alfalfa with herbicides and direct seed an annual crop. Benefits of using this system over traditional tillage methods include:

1) Tillage operations required to work under alfalfa are expensive and require additional amounts of manpower.

2) Tillage increases the risk of soil erosion and reduces many of the soil improvement benefits associated when using alfalfa in a crop rotation.

3) Direct seeding annual crops into a sprayed out alfalfa field reduces the number of annual weeds especially in the first year. In most cases the number of wild oats present in the field are minimal and not high enough to justify spraying, saving the producer $15-$18/acre. This savings covers the cost of herbicides to spray out the alfalfa stand.

4) Using herbicides to remove alfalfa also provides an opportunity to control perennial weeds such as quackgrass, dandelions, and Canada thistle.

Removing Alfalfa with Herbicides

The underlying success of direct seeding an annual crop into an alfalfa stand depends on how well the existing vegetation is controlled. The degree of control attained will depend on selecting the proper herbicide and applying it at the proper time.

Ideally alfalfa should be sprayed out the year prior to direct seeding an annual crop. There are several reasons for this. Fall spraying is more effective than spring spraying (Tables 2 and 3). Spring soil moisture conditions will be higher on alfalfa fields sprayed out the previous fall versus fields sprayed in the spring. Fall spraying will provide another opportunity in the spring to spray any plants that were not controlled with the first herbicide application. Spraying the previous year allows time for the alfalfa roots to break down resulting in a more suitable seed bed and also allows more time for nitrogen mineralization and build up in the soil. Fall spraying allows for earlier seeding than spring spraying since there must be sufficient alfalfa growth present prior to spraying in the spring. All of these factors will translate into higher annual crop yields on fall sprayed alfalfa versus spring sprayed alfalfa as shown in Table 1 below. Trials conducted in Alberta on spraying out mixed forage stands and direct seeding barley, canola and peas also showed that yields were higher on fall sprayed treatments versus spring sprayed.

TABLE 1. Influence of method and time of alfalfa stand termination on grain yield of Katepwa wheat in Manitoba. Average of three sites. (Proceedings of the Western Canada Agronomy Workshop: Rotational Benefits of Forage Crops in Prairie Agriculture)

Termination Method	Termination Time*	Grain Yield (kg/ha)
Herbicide + Direct Seed	after 1st cut	2557
Herbicide + Direct Seed	after 2nd cut	2414
Herbicide + Direct Seed	spring	2179
Tillage	after Ist cut	2630
Tillage	after 2nd cut	2450

*After first cut in year prior to wheat cropping (mid-June).
After second cut in year prior to wheat cropping (early September).

Results from two trials conducted in Alberta (Table 2 and 3) indicate fall spraying in alfalfa provides better control than spring spraying. The best time to spray out alfalfa is on regrowth following the first cut providing there is a minimum of 8-10 inches of growth present or in the bud or blooming stage.

In most cases grasses and dandelions are also present in an alfalfa field so a herbicide with glyphosphate should be used. If spraying in the fall on regrowth from the first cut, 1.5-2 l/acre of Roundup appears to provide reasonable control of alfalfa. Generally the closer the alfalfa is to flower, the better the control using translocated herbicides such as glyphosphate. Grasses should have 3-4 leaves/stem and actively growing.

Spraying can take place late in the fall assuming sufficient alfalfa growth is present and weather conditions are suitable. Research work at Agriculture-Canada Brandon Research Station indicates Roundup's effectiveness on a perennial such as quackgrass may be reduced when air temperatures are below 15°C. This is especially true at application rates below 1 litre/acre. As application rates of Roundup increase, the effect of temperature deceases. It is also important that the 3 days following Roundup application, air temperatures are in the mid-teens to ensure Roundup is translocated to the roots. Spraying alfalfa following a -2 or -3°C frost is possible if the alfalfa is not noticeably damaged and allowed to recover for 2-3 days prior to spraying. This is also assuming air temperatures remain suitable after the herbicide has been applied.

Spraying out alfalfa in the spring and direct seeding a crop can be risky especially under dry weather conditions. Alfalfa must be allowed to grow in the spring prior to spraying which could result in low soil moisture conditions. If moisture is not received shortly after seeding emergence will be poor.

When planning to spray out alfalfa in the spring the best treatments appear to be 1-1.5 l/acre of Roundup plus Banvel at 150 ml/acre or 2-4,D ester at 450 ml/acre. Roundup alone applied in the spring does not provide effective control of alfalfa. Spring sprayed alfalfa should have at least 6 inches of growth prior to spraying. One treatment that was used on a field scale level on alfalfa sprayed in the spring was Rustler at 1.5 l/acre + Roundup at 3/4 l/acre. The cost of the herbicide mix was $14.64/acre. This mixture provides very good control of alfalfa, quackgrass and dandelions. This mixture works out to Banvel at 188 ml/acre + Roundup at 1.25 l/acre but is approximately $2.50/acre cheaper than tank mixing. The cost for spraying out alfalfa is between $12-$17/acre depending on the herbicides and rates used.

TABLE 2. Control of alfalfa with herbicides applied in the fall versus spring. (Monsanto Data, 1995)

Treatment	Rate l/acre	% Control Fall Application	% Control Spring Application	Cost $/acre
Roundup	1	90	20	8.95
Roundup	1.5	93	33	13.43
Roundup	2	96	53	17.90
Roundup + 2-4,D ester	1 + .400	95	86	12.70
Roundup + 2-4,D ester	1.5 + .400	95	91	17.18
Roundup + Banvel	1 + .120	90	84	12.55
Roundup + Banvel	1.5 + .120	91	90	13.43

* Fall treatments applied on September 2, 1994. Spring treatments applied on May 28, 1995.
** Ratings taken June 7, 1995.

Roundup is registered as a pre-harvest treatment that can be applied to forage crops prior to grazing or cutting for hay. This practice provides an opportunity to spray on first or second cut alfalfa and still make use of the forage material. The sprayed forage material can be grazed or fed to livestock. A minimum of 3 days prior to grazing or 3-7 days prior to cutting for hay is required for the Roundup to work effectively. If alfalfa is sprayed out on the first cut a burnoff the following spring will likely be necessary as some alfalfa may grow back.

Monsanto states quality is not affected within 7 days of spraying Roundup. Trials conducted by SARDA and Falher Alfalfa in 1995 showed a 3% drop in protein on alfalfa 5 days after spraying 1.5 l/acre of Roundup at one site and a 5% decrease in protein content at day 6 at another site. In 1996 results from another trial showed that the 1.5 l/acre treatment of Roundup did not cause a loss in protein until 9 days after spraying Roundup. This may be a concern if selling alfalfa hay into a high quality market. Leaving the sprayed alfalfa standing longer than 7 days will certainly start to have an effect on protein and fibre levels.

TABLE 3. Control of alfalfa with herbicides applied in the fall versus spring. (SARDA, 1997)

Treatment	Rate l/acre	% Control Fall Application	% Control Spring Application	Cost $/acre
Roundup	1	92	69	8.95
Roundup	1.5	100	73	13.43
Roundup	2	100	88	17.90
Roundup + 2-4,D ester	1 + .5	100	86	13.64
Roundup + 2-4,D ester	1.5 + .5	100	94	13.45
Roundup + Banvel	1 +.150	100	78	18.12
Roundup + Banvel	1.5 +.150	100	84	17.93
Roundup + Rustler	1.0 + 1.0	100	90	14.90

* Fall treatments applied September 12, 1996 on alfalfa 12-15" tall.
Spring treatments applied on May 18, 1997 on alfalfa 7 inches tall.
** Ratings conducted on June 7, 1997.

Crop Selection

Crop selection should be based on the competitive ability of the crop and what in crop herbicides are available for spraying out volunteer alfalfa and dandelions. Crops with large seeds are also preferred as seed bed conditions may not be suitable for small seeded crops. Cereals such as oats, wheat or barley have shown good results when direct seeded into alfalfa ground. Oats has done particularly well. Barley likely performs the worst of the three cereals as it seems to be more sensitive to stress conditions and diseases. Winter wheat or fall rye could also be tried assuming the alfalfa was sprayed out early enough in the year.

Seeding peas into alfalfa is not a good practice as there are no herbicides to spray out volunteer alfalfa. Peas are also able to fix their own nitrogen so it would be preferable to seed a crop that will take advantage of the nitrogen available in the soil. Very poor results have been observed when producers have direct seeded peas into alfalfa.

Canola could also be considered but generally cereals are the preferred choice in the first year especially if the alfalfa was sprayed out in the spring. Lontrel could be used to provide good control of volunteer alfalfa in canola. The second year would likely work better for canola.

Fertility

Alfalfa harvested as hay will remove large amounts of nutrients from the soil. Ensure that good rates of phosphorus, potassium and sulphur are used at seeding. Soil nitrogen levels from terminated alfalfa stands are difficult to predict. Release of nitrogen from the breakdown of alfalfa material is a gradual process. The amount of nitrogen applied to the crop will depend on when the alfalfa stand is terminated. The longer the period between alfalfa termination and seeding of the annual crop the higher the levels of nitrogen are available in the soil. There would be very little difference in soil nitrogen between late fall or early spring termination of alfalfa. Until further studies are conducted it should be suggested to use recommended rates of nitrogen normally used. The extra nitrogen released over time will be a bonus in terms of improving yields and protein of the crop.

Terminating an alfalfa field with herbicides and direct seeding an annual crop into it will result in better crop utilization of nitrogen than when the field is terminated using tillage. Tillage results in a faster breakdown of nitrogen from forage residue which results in nitrogen becoming available sooner but also allows for higher losses. Nitrogen is gradually released over a period of time in a sprayed out alfalfa field so that as the nitrogen becomes available the annual crop will use it up. The end result is more efficient use of nitrogen by annual crops on sprayed out alfalfa fields.

In-Crop Herbicides

Very seldom will the first application of a herbicide provide 100% control of alfalfa or dandelions. For this reason it is important to select a crop that has in-crop herbicides for control of volunteer alfalfa or dandelions. Cereals could be sprayed with products such as Target. Dyvel, Lontrel or Ally to control volunteer alfalfa. 2-4,D or MCPA applied alone will not provide very good control of alfalfa unless used in a tank mix with other herbicides. In canola crops Lontrel could be used. Liberty on Liberty tolerant canola would also work well although it likely would not provide long term control. There are no in crop herbicides for control of volunteer alfalfa in peas.

In most cases there should not be a need to spray for wildoats. This results in a savings of $15-18/acre. This has been seen on both field scale and research trials. One trial conducted in Manitoba showed the density of green foxtail was 47.5 plants per meter square in the tilled alfalfa versus 4.7 plants /m^2 where alfalfa was sprayed the previous fall. Lambs quarter populations were 65 and 11 plants/m^2 in the field versus untilled plots respectively (Entz 1995).

A method that seems to work well at controlling volunteer forages in annual crops is the use of Roundup as a pre-harvest treatment. Smoky Applied Research and Demonstration Association (SARDA) has shown excellent trial results at controlling volunteer alfalfa, red clover and perennial weeds such as dandelions, Canada thistles and quackgrass using this method. At one site volunteer red clover was reduced from 12.3 plants/m^2 to .5 plants/m^2 by spraying pre-harvest Roundup on a wheat crop (SARDA Annual report 1995).

Yields

Table 1 shows results from trials conducted in Manitoba on spraying out alfalfa with herbicides and direct seeding wheat versus using tillage operations. Wheat yields between the two systems were similar. Wheat yields were higher when the alfalfa was sprayed out the previous year versus spraying in the spring.

Several producers in the Falher area have used this method to remove alfalfa from rotation and the results have been very positive. In 1996, one producer north of Donnelly sprayed out an alfalfa field the third week of May with 1 l/acre of Roundup + 150 ml of Banvel and seeded oats 3 days later with a Morris air drill. The treatment gave fairly good control of alfalfa, dandelions and quackgrass. Target was sprayed in crop to control volunteer alfalfa. The field was very clean of weeds. There was virtually no wildoats present. The oat crop ended up yielding around 115 bu/acre.

In 1997, three producers south of Girouxville sprayed out three separate fields of alfalfa using 1½ l/acre of Rustler plus 3/4 litre of Roundup during the third week of May. The herbicide treatment worked very well at controlling alfalfa, dandelions and quackgrass. One producer seeded oats, one producer seeded barley and one producer seeded wheat. All crops were direct seeded with a Conservapak air drill. Results were excellent. There were very few wildoats in the fields and alfalfa regrowth was minimal. The oat crop yielded 105 bu/acre, barley 60 bu/acre and wheat 35 bu/acre. In both 1996 and 1997 the springs were extremely wet which helped ensure sufficient moisture was available for the seed to germinate and grow on alfalfa fields sprayed out in the spring. It should be noted that seeding annuals into spring sprayed alfalfa is far more riskier than seeding into fall sprayed alfalfa..

Direct seeding into alfalfa stands is showing excellent potential. There is still some fine tuning to be done on the practice but it shows good promise. It is important that each producer designs his own program to meet his individual requirements for removing alfalfa based on the equipment he has available to use. Direct seeding into alfalfa stands requires an integrated approach of different cropping practices to ensure success is achieved.

References

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Entz, M.H., W.J. Bullied, R.M. Mohr, A. Schoofs, and K.C .Bamford.1995. Rotational Benefits of Forage Crops in Prairie Agriculture. p 24-33. Proceedings Western Canada Agronomy Workshop, July 5 to July 7, 1995. Red Deer, Alberta.

Entz, M.H. The Role of Forages in Prairie Crop Rotations. Proceedings From Alfalfa Grazing Seminars. December, 1994.

Smoky Applied Research and Demonstration Association 1996 Annual Report.

Corn Starch Effect on Yield of Zero-till Wheat

Garry Ropchan, Research Coordinator
Central Peace Conservation Society (CPCS), Spirit River

DOES STARCH HAVE A USE OTHER THAN IN MAKING GRAVY?

- CPCS has been conducting around 20 trials each year
- these trials deal with a number of basic agronomic questions, which is the better of these different fertilizer rates, herbicides, drills etc.
- every once in a while there is a product that hits the market that sounds a little strange
- some examples of this would be products like Nitrozyme, Power Rich, Bioplus, Agrispon and Basic-H
- this is not to say that they might not have worked but the claims were high
- they always used a lot of testimonials in their ads, but properly conducted trials never found responses
- an article in "No Till Farmer" reported that they were getting yield increases in wheat from using of all things - starch
- starch is found in potatoes, wheat, rice and corn
- starch is used as a thickener in cooking and food preparation (making gravy) and as a stiffener when pressing clothes - stiffening agent
- a university researcher reported that he was getting yield responses from applying starch when zero tilling wheat
- he reported increases in wheat yields of 8 to 20% over 5 years by applying 20 lb/ac of starch
- I'm always interested in a yield response, more so when the product could be produced from a local, renewable resource like wheat!
- currently no producers of starch in Canada, all is brought in from the U.S.
- starch is not a dangerous product, is tasteless and is a white powder or granule
- I contacted the company and they were generous enough to send me up a sample
- Monsanto provided us with some land to use
- this was sprayed with 1.0 l/ac Roundup 1.0l/ac A.S. in 5 gal/ac water on May 5 to remove dandelion, quackgrass and NLHB
- we seeded Roblin wheat at 110 lb/ac 1" deep, 8 row drill with Flexi-Coil Stealth openers
- the fertility program was 75-35-0-0 and 20 lb/ac starch, all was deep banded
- incrop weed control was the recommended rate of Prevail with 60 ml/ac additional Lontrel on July 4
- no visible differences were observed during the growing season and the plot was straight cut on October 3
- starch costs are about $0.44 per pound Canadian
- rumors are that a plant is scheduled to open up in Alberta to supply Canadian food industry needs and perhaps maybe agricultural needs in the future

Results of Starch Trial

Treatment	Yield bu/ac*	% Dockage*	Gross $/ac	Starch $/ac	Net $/ac
No Starch	42.1a	7.5a	138.93	0.00	138.92
Starch	46.2 b	7.3a	152.46	8.80	143.66

*means within each column followed by the same letter were not significantly different at P=0.05, feed wheat price used was $3.30/bu

Why would this happen?

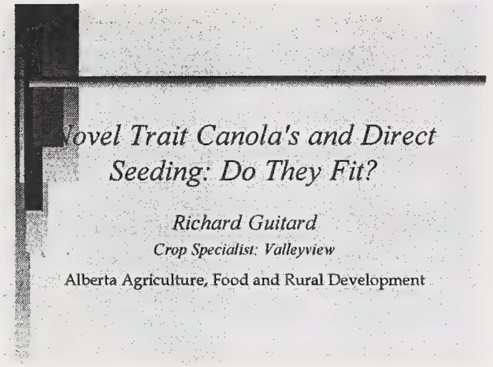
- no one knows!
- it is relatively new so little attention has been paid to starch as a crop enhancement
- the original researcher is not sure himself but has two possible theories on the subject:
  1) starch is high in carbon, this could be a food source for soil micro-organisms
  2) starch absorbs water, this may help dissolve the fertilizer granules it is deep banded with or the roots may be able to use the water during a drought
- starch is available in powder or granules, granules preferred as powder may start to cake up air tubes and shanks etc.
- work in 1998 may study rates or crops

Additional Comments

- starch applications are taking place on field scale in the U.S.
- current practice is to get starch blended with fertilizer prior to filling drill

Novel Trait Canola's and Direct Seeding: Do They Fit?

Richard Guitard, Crop Specialist

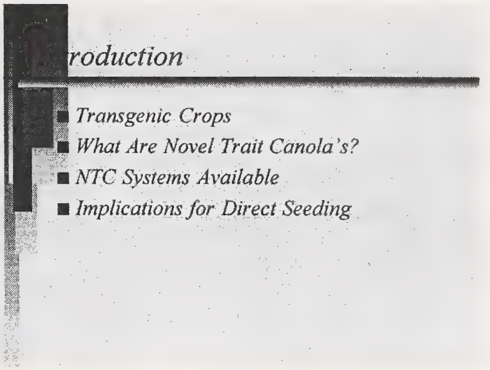


ovel Trait Canola's and Direct Seeding: Do They Fit?

Richard Guitard

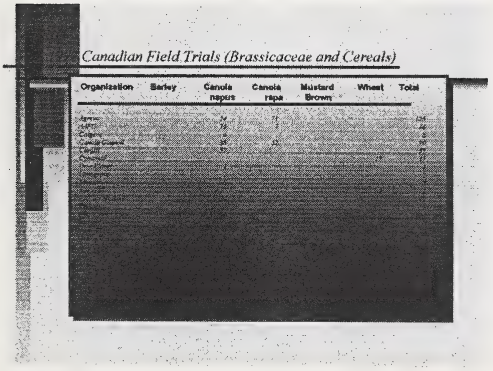
Crop Specialist: Valleyview

Alberta Agriculture, Food and Rural Development



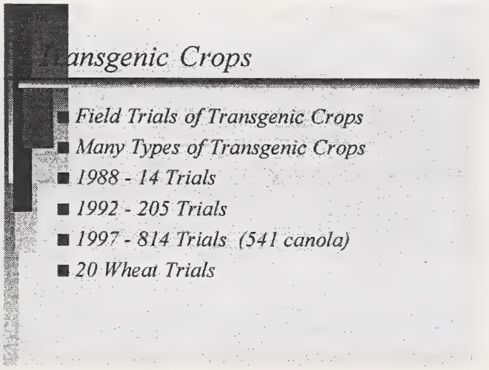
roduction

- *Transgenic Crops*
- *What Are Novel Trait Canola's?*
- *NTC Systems Available*
- *Implications for Direct Seeding*



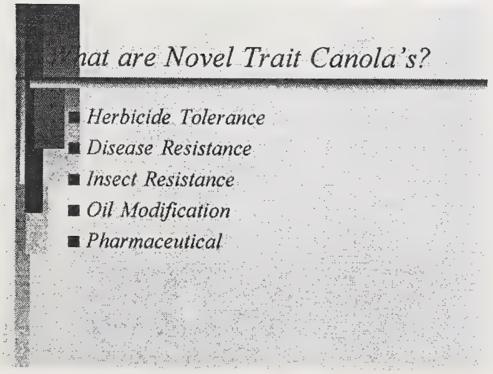
Canadian Field Trials (Brassicaceae and Cereals)

Organization	Barley	Canola napus	Canola rapa	Mustard Brown	Wheat	Total



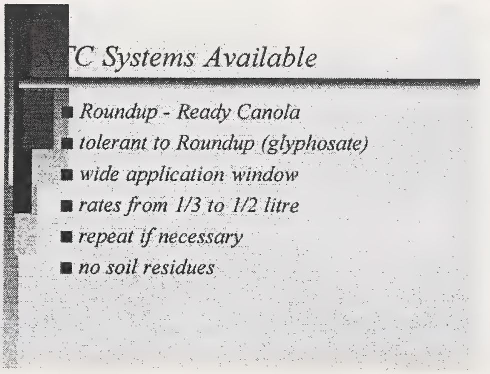
ansgenic Crops

- *Field Trials of Transgenic Crops*
- *Many Types of Transgenic Crops*
- *1988 - 14 Trials*
- *1992 - 205 Trials*
- *1997 - 814 Trials (541 canola)*
- *20 Wheat Trials*



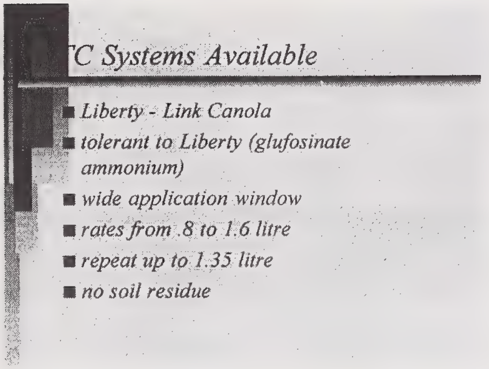
at are Novel Trait Canola's?

- *Herbicide Tolerance*
- *Disease Resistance*
- *Insect Resistance*
- *Oil Modification*
- *Pharmaceutical*



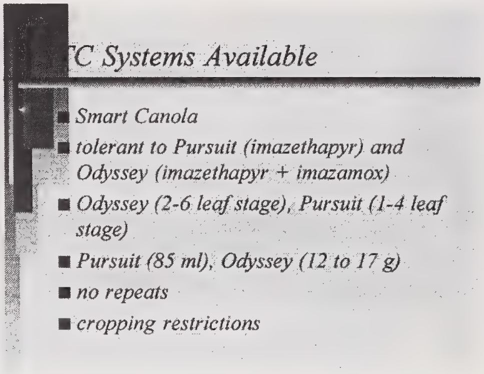
C Systems Available

- *Roundup - Ready Canola*
- *tolerant to Roundup (glyphosate)*
- *wide application window*
- *rates from 1/3 to 1/2 litre*
- *repeat if necessary*
- *no soil residues*



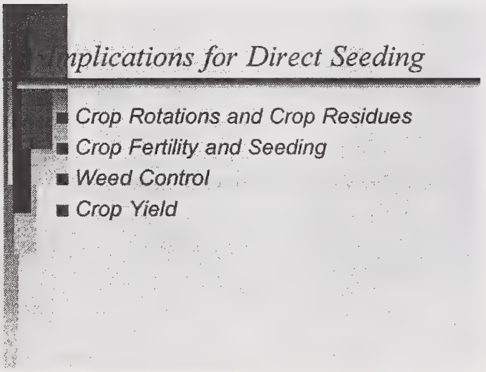
TC Systems Available

- Liberty - Link Canola
- tolerant to Liberty (glufosinate ammonium)
- wide application window
- rates from .8 to 1.6 litre
- repeat up to 1.35 litre
- no soil residue



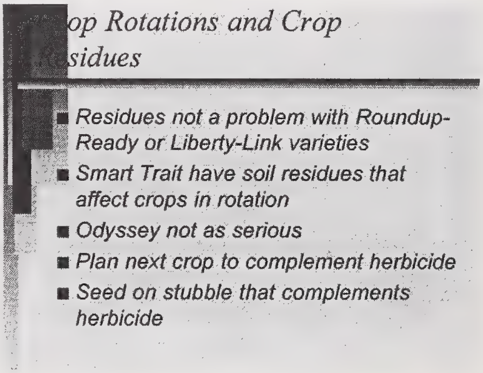
TC Systems Available

- Smart Canola
- tolerant to Pursuit (imazethapyr) and Odyssey (imazethapyr + imazamox)
- Odyssey (2-6 leaf stage), Pursuit (1-4 leaf stage)
- Pursuit (85 ml), Odyssey (12 to 17 g)
- no repeats
- cropping restrictions



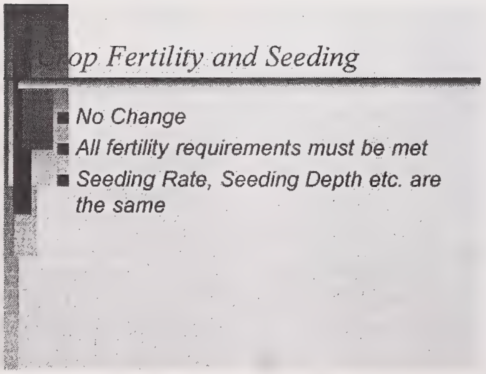
Implications for Direct Seeding

- Crop Rotations and Crop Residues
- Crop Fertility and Seeding
- Weed Control
- Crop Yield



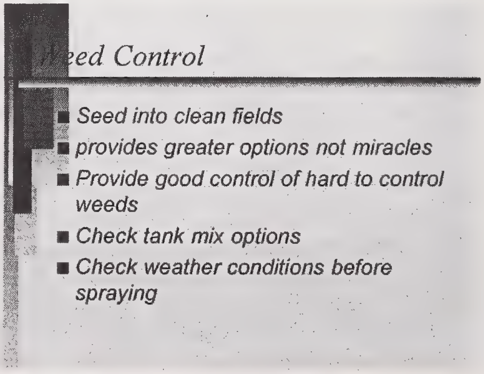
op Rotations and Crop Residues

- Residues not a problem with Roundup-Ready or Liberty-Link varieties
- Smart Trait have soil residues that affect crops in rotation
- Odyssey not as serious
- Plan next crop to complement herbicide
- Seed on stubble that complements herbicide



op Fertility and Seeding

- No Change
- All fertility requirements must be met
- Seeding Rate, Seeding Depth etc. are the same



Weed Control

- Seed into clean fields
- provides greater options not miracles
- Provide good control of hard to control weeds
- Check tank mix options
- Check weather conditions before spraying

op Yield

- *Yields are the same or better than checks - Provincial results*
- *In 1996 test near Warburg - Roundup-Ready and Liberty-Link compared with regular direct-seed and conventional seed.*
- *Showed that varieties used yielded same as check and more than conventional seed*
- *New hybrids coming that should provide significant yield advantage*

mmary

- *Be careful with rotations - residue and herbicide weakness*
- *Fertility and seeding practices the same*
- *Weed control options increased*
- *All novel trait canola susceptible to 2,4-D*
- *Weed control satisfaction relates to weeds, growth stage and weather*
- *Yields comparable with regular varieties and better varieties coming*

Pea Disease Management in Conservation Tillage

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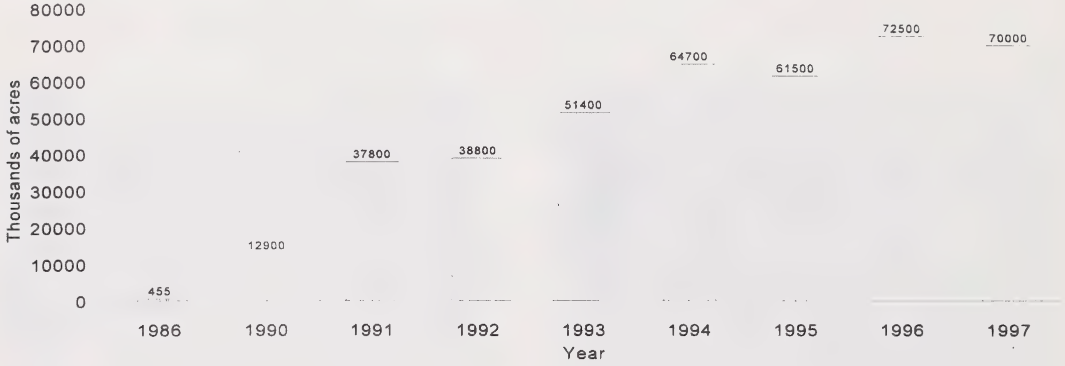
Peas have been grown in the Peace region for many years but on a small scale. The 1986 Census recorded only 455 acres of peas growing in the region. Production really took off in the 1990's with a steady increase throughout the decade. The 1996 Census listed 72,400 acres in the region. Figure 1 shows how acreage has increased since 1986.

Figure 1: Acreage of Field Peas in Peace Region of Alberta 1986 - 1997



Peas have proven themselves to be very well adapted to conservation tillage. Yields of peas grown under minimum or zero tillage have been equal or superior to peas grown on conventional tillage. Yields of peas grown under conservation tillage were 17% higher than conventional tillage in Fort Vermilion, 9% higher in Indian Head, Saskatchewan and 12% higher in Morden, Manitoba. More nodules were always present on peas grown under conservation tillage and seed weight was usually higher.

As the acreage of peas in the region has increased, so has the incidence of disease. A disease survey of pea fields was done during the 1997 growing season and revealed some interesting findings. One hundred and three fields were surveyed three times during the summer and 74 growers were also questioned about their production practices. These 74 growers represented 24% of the pea acreage in the region making the survey data quite reliable.

Seventy percent of growers in the survey were growing their peas under conservation tillage. Forty percent of fields were minimum tilled and 30% were zero tilled. The region was broken into six areas and fields were sampled according to the number of growers in each area. Both root and foliar diseases were assessed. Root rot was assessed according to root rot incidence and severity. Incidence is the percentage of plants collected that had symptoms of root rot. Severity is based on a scale of 0 - 4, where 0: healthy root with no discolouration, 1: 1 - 10% root discolouration, 2: 11 - 25% root discolouration, 3: 26 - 50% root discolouration, and 4: 51 - 100% root discolouration.

Peas with root rot were found in all fields surveyed. Mean incidence and severity increased in all areas as the summer progressed. The mean incidence and severity of root rot for the three surveys were: 88% and 1.2, 88% and 1.5, and 95% and 2.3, respectively. Table 1 details the mean incidence and severity for the six areas surveyed in the Peace.

Table 1: Incidence and severity of root rot in the Peace region in 1997.

Area	Location	Survey 1					Survey 2					Survey 3				
		# of fields	Incidence %		Severity		# of fields	Incidence %		Severity		# of fields	Incidence %		Severity	
			Mean	Range	Mean	Range		Mean	Range	Mean	Range		Mean	Range	Mean	Range
1	Manning Ft. Vermilion	12	83	55-100	1.1	0.6-1.9	12	78	55-100	1.2	0.7-1.8	12	98	87-100	2.6	1.8-3.5
2	Berwyn Fairview	33	82	36-100	1.1	0.4-3.0	33	91	56-100	1.6	0.8-2.9	33	90	28-100	1.8	0.4-3.8
3	Spirit River Eaglesham	11	89	61-100	1.0	0.6-1.4	11	92	82-100	1.5	1.0-2.1	11	100	100-100	2.4	2.1-2.9
4	Debolt Grande Prairie	29	94	62-100	1.3	0.6-2.3	23	95	86-100	1.8	0.8-4.0	26	98	76-100	2.6	1.4-4.0
5	Falher Peace River	8	93	81-100	1.0	0.8-1.2	7	51	13-100	0.8	0.2-2.5	7	85	69-100	1.9	1.3-3.3
6	Valleyview High Prairie	10	95	85-100	1.3	1.0-1.8	10	98	91-100	1.6	1.1-2.2	10	99	94-100	2.7	1.8-3.6
	Total Average	103	88		1.2		96	88		1.5		99	95		2.3	

Root rot severity ratings:

0: healthy with no root discolouration
1: 1-10% root discolouration
2: 11-25% root discolouration
3: 26-50% root discolouration
4: 51-100% root discolouration

The total number of fields varied from survey to survey because of worked under crops, road construction and harvested fields.

The main root rot organisms identified were *Fusarium* spp., *Rhizoctonia* spp. and *Botrytis cinerea*. *Fusarium* spp. were the most common being found in every field in the survey. *Fusarium* spp. cause Fusarium root rot, a disease characterized by reddish brown streaks developing on the primary and secondary roots and eventually coalescing to form a dark reddish brown colour on the primary root up to the soil line. Graying, yellowing, necrosis of lower foliage, and stunting can all occur if infection is severe.

The main foliar pathogens identified were *Ascochyta* spp., *Sclerotinia sclerotorium*, *Fusarium* spp., and *Botrytis cinerea*. *Ascochyta* spp. cause Ascochyta blight (also called Mycosphaerella blight) and was the most common foliar disease identified in the survey. Symptoms of

Ascochyta blight were found in all fields by the third survey. *Sclerotinia sclerotorium* causes Sclerotinia rot and it was the second most common disease found. It was present in 54 of the fields by the third survey. The other pathogens found were of minor importance. Ascochyta blight causes small, brown to purplish, irregular flecks without definite margins to initially appear on pods, leaves, stems and the cotyledonary area. These lesions enlarge if weather conditions are favourable. Optimal temperature for disease development is between 15°-18°C. Dark-brown to black pycnidia are eventually produced and as the lesions enlarge, a distinct concentric tan and brown ring pattern is formed. This is often more pronounced on leaves and pods than on other plant parts. Lesions developing on stems tend to form long, wide purple to bluish-black streaks which eventually coalesce and may completely girdle the stems, pedicels or tendrils. These streaks are more common near the nodes and on the lower portion of the stem. Pod infection can lead to seed infection if it occurs early enough. Seed infection may show no visible symptoms if infection is light to varying degrees of shrinkage and discolouration if severe. Under drier conditions, the concentric ring pattern of the disease is less pronounced and symptoms may show up only as a uniform yellowing of lower leaves. If the blossom becomes infested, girdling of the sepal often occurs leading to pod drop or distortion. Researchers in Australia showed that in southern Australia, yield was closely correlated to disease severity. For most pea varieties in their study, there was a 5 to 6 percent yield reduction for every 10 percent of the stem area affected by ascochyta blight.

This leads to the main reason for this presentation and that is how does conservation tillage affect diseases in peas. A literature review of research done in this area revealed some interesting findings.

Bailey *et al*. (1997) in some research done in Saskatchewan looked at how pea diseases are affected by tillage methods. Their research found that any residue that is left on the soil surface decomposes more slowly than when worked into the soil. Results from their seven year study showed that Mycospheraerella blight severity was lower under conventional tillage than under zero tillage but there were no differences in yield. Root rot cause by *Fusarium* spp. was sometimes lower under conventional tillage but there was no difference at maturity between conventional tillage, minimum tillage and zero tillage.

Gossan *et al*. (1996) in a four year study in Saskatchewan found no consistent effect of tillage on the severity of Fusarium root rot and Mycosphaerella blight in peas. They found that pea yields in the zero and minimum tilled plots were consistently higher than in their conventional plots. They concluded that tillage practices do not affect disease severity when there is at least three years between successive pea crops.

Turkington *et al*. (1997) in a four year study in Fort Vermilion found that root rot severity was always higher under conventional tillage than under zero tillage. They also found pea yields to be consistently higher under zero tillage.

Tu *et al*. (1992) in a study of root rot in Ontario pea fields found that soil compaction increased both the incidence and severity of Fusarium root rot.

In a study on Sclerotinia rot, Bailey *et al.* (1996) found that the incidence of Sclerotinia rot is always higher in canola when peas are in the rotation. They found that 24% more sclerotia survive on the soil surface than when buried. Burial to at least 4 inches is recommended. However, any additional tillage during the growing season return the sclerotia to the surface before degradation could occur and canceled the benefit of tillage for control of Sclerotinia rot. They also found that high soil moisture decreases the sclerotia survival and since soil moisture is always higher under zero and minimum tillage, they deduced that heavy residue of a non-host crop will increase soil moisture and microbial activity which should decrease the survivability of sclerotia. They concluded that there was no greater risk of Sclerotinia rot with minimum or zero tillage than with conventional tillage.

Lafond *et al.* (1997) in a study on row spacing and its effects on disease found that wider row spacing sometimes decreased disease levels by allowing greater air flow through the canopy. They concluded that using wider row spacing should not have any effect on disease severity. But they also cautioned that more research is needed in order to be crop and area specific.

What can be deduced from all this research?

1. Crop rotation is the most effective strategy for dealing with diseases under conservation tillage. For peas, at least four years is recommended between pea or other legume crops such as alfalfa and clovers.
2. Use seed with high vigour. Tests for vigour are available from private seed testing labs in Alberta. High vigour seed will germinate and get out of the ground much sooner than peas with low vigour. This will decrease the amount of time the peas are susceptible to infection by root rot pathogens.
3. Use seed treatment. Thiram 75 WP, Captan FL and Apron FL are all registered for use on peas and will provide protection against root rot, seedling blight and seed rot.
4. Reduce soil compaction. This can be done by subsoiling. Fields that have been in zero till for a number of years will have reduced levels of soil compaction but if a field is new to zero till, it may be a good idea to subsoil to break up the hardpan before seeding peas.
5. If you notice Ascochyta blight in your peas can spray with Bravo 500 fungicide. This will protect the plants against infection for 7 to 10 days. Application can begin around the time that flowering begins and be repeated up to three times at 7-10 day intervals if weather conditions are conducive to development of the disease.
6. There are no fungicides registered for sclerotinia rot control in peas. One to two years between pea and canola crops should reduce the problem somewhat. Any control would have to be done in a canola crop to prevent the buildup of sclerotia in the field.

To conclude, peas are very well adapted to conservation tillage showing equal or superior yields to peas grown in conventionally tilled fields. Disease should not be any more of a problem than in conventionally tilled fields as long as a good crop rotation is followed allowing at least four years between successive pea crops. Most pea growers will tell you that peas need more management than cereals or canola but the returns can be very rewarding if the attention is given to extra management.

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